Department: Mathematics
Year: Fourth
Section: Mathematical/physics
Course Code: Math 406
Course Title: Real Analysis
Term: First, 2015/2016
Date: 3 / 1 /2016
Time Allowed: 2 hours
Total points: 100 point
Dr. Name(s): Fatma Gaafar

Answer the following questions

(State the theorem or property you use in every case)

(1)a- [7 points] If $\mathbf{p}^*$ is the refinement of a partition $\mathbf{p}$,

What we mean by refinement p^*, prove that $\mathbf{L(p,f,\alpha) \le L(p^*,f,\alpha)}$

b- [6 points] Explain the Riemann-Stieltjes sense of integration and show when the function $\mathbf{f(x)}$ is integrable in this sense.

c- Give an example of a function f(x) and integrator α (x) such that $\mathbf{f \notin R[a,b]}$ but $\mathbf{f \in RS[a,b]}$.

d- [7 points] Solve the following RS-integrals $\int_0^2 \mathbf{x\, d([x]-x)}$

e- [8 points] Use the definition of Riemann-Stieltjes integral solve the integral $\int_0^1 \mathbf{x\, dx^2}$

انظر خلفه

(2) (i) **Prove that**

(a) H = [0 , ∞) is not compact.

(b) The union of any finite collection of closed sets is closed.

(c) If A_n is a closed set. Is $\bigcup_{n=1}^{\infty} A_n$ closed ? (justifying your answers)

(d) A set containing a finite number of points is a closed set.

(e) a set is closed iff its complement is open.

(ii) **Define each of the following terms**

closed set, limit point , closure of a set, compact set , everywhere dence

---

(3)**a-** Define the point-wise convergent and uniform convergent of sequence and series.

b- State and prove M_n- test for a sequence of functions

c- Show that the sequence $\{f_n(x)\}$ where

$f_n(x) = n\,x\,(1-x)^n$ is not uniformly convergent on $[0,1]$.

d- Show that the series $\sum_{n=1}^{\infty} \frac{x}{(nx+1)\{(n-1)x+1\}}$ is uniformly convergent on any interval $[a,b]$ where $0 < a < b$, but only point-wise convergent on $[0,b]$.

e- State when the series of functions can be integrated term by term.

مع أطيب التمنيات بالنجاح والتوفيق

Damanhour University
Faculty of Science
Department of Mathematics

Course Code	Math 101
Course Name	Analytical Geometry
Level	First
Total Marks	70

Term	First
Date	28 / 12 / 2015
Time Allowed	2 hours
Dr. Name(s)	Safaa Abd El-Rahman

FINAL EXAM

Answer the following questions

Question No. 1 **(marks)**

a. Reduce the equation $\sqrt{3}\,x + y - 7 = 0$ to normal form and hence find the value of p and $\propto$.

b. Given the equations of two members of a combined set of circles in the form $S_1 \equiv 9(x^2 + y^2) + 18x + 5 = 0$, $S_2 \equiv 9(x^2 + y^2) + 18y + 5 = 0$. Obtain the two limiting points of this group of circles.

c. Prove that the equation $4x^2 + 6xy - 18y^2 + 14x - 12y + 6 = 0$ represents two lines, also find these lines and their point of intersection.

With my best wishes

Course Code: M251
Course Title: Mechanics (3)
Year: Fourth
Section: Physics/math
Term: First (2016)
Time Allowed: 2 hours
Total Points: 70
Date: 28/12/2015
Dr.: Shreen Elsapa

Damanhour University
Faculty of Science
Department of Mathematics

Answer All Questions

Q1: **(Mark 15)**

a) Find the directional derivative of $f(x,y)=x^2yz$ in the direction $4\vec{i}-3\vec{k}$ at the point (1,−1, 1).

b) Find grad$f$ for $f=\rho^3\sin\phi$. Show that the results are consistent with those found using cartesian coordinates.

c) Prove that $\nabla^2 f(r)=\frac{d^2f}{dr^2}+\frac{2}{r}\frac{df}{dr}$ and deduce

$$\nabla^2 r^n = n(n+1)r^{n-2},\ \nabla^2(1/r)=0$$

Q2: **(Mark 30)**

a) Prove that $\vec{F}=(y^2\cos x+z^3)\vec{i}+(2y\sin x-4)\vec{j}+(3xz^2+2)\vec{k}$ is a conservative field, find the scalar potential, and find the work done to move a particle in this field from A(0,1,1) to B($\frac{\pi}{2}$,-1,2).

b) Verify the Divergence Theorem for the field $\vec{F}=\langle x,y,z\rangle$ over the sphere $x^2+y^2+z^2=a^2$

c) Let C be the curve defined by the parametric equations

$x=0,\ y=2+2\cos t,\ z=2+2\sin t,\ \ 0\le t\le 2\pi$.

Use Stokes Theorem to evaluate

$$\int_C x^2e^{5z}dx+x\cos y\,dy+3y\,dz.$$

Please turn over

Q3: **(Mark 10)**

Two equal forces R act along two diagonals of two parallel forces of a cube, whose edge is a. Prove that the central axis of the system of forces passes through the center of the cube. Determine the resultant wrench and its pitch.

Q4: **(Mark 15)**

Find the moment of inertia of

a) Uniform circular wire of mass M and radius a about its axis.

b) Uniform rectangle plate of sides 2a, 2b and mass M about a side of length 2b, 2a and its one vertex.

With My Best Wishes

جامعة دمنهور
كلية : العلوم

القسم	الرياضيات	الفصل الدراسي والتاريخ	الأول 2015-2016
البرنامج	تخلفات الفرقه الرابعه	زمن الامتحان	120 دقيقه
اسم المقرر ورمزه	ر111	الدرجة الكلية للامتحان	70
اسماء لجنة وضع وتصحيح الامتحان	د. رجب عمر / د.حامد كمال / د.محمد منولي		
تعليمات الامتحان وطريقة الاجابة	أجب عن الاسئله موضحا كل خطوه وتفاصيل الحل هذه الاسئله خاصه بالجزء الثاني (الجبر +الهندسه)		

Question 1:

a- Discuss and sketch the given curve $y^2 - 8x - 6y = 7$.(5grades)

b- Solve the linear equations $x_1 + 3x_2 + x_3 = -2,$
$2x_1 + 5x_2 + x_3 = -5$
$, x_1 + 2x_2 + 3x_3 = 6.$ (6grades)

c- For the given equation $x^2 + y^2 - 3x + 10y = 15$,find,
i- The radius and the center of the circle.
ii- The equation of the tangent and normal lines to the circle at the point (4,-11). (5grades)

Question 2:

a- Prove that the given equation may represents pairs of straight lines $,12x^2 + 7xy - 10y^2 + 13x + 45y - 35 = 0$.Hence find,
i- The angle between them.
ii- The intersection point between them (10grades)

b- Calculate the given number $\left(\sqrt{3} + i\right)^{10}$, in the form $a + ib$,where $i = \sqrt{-1}$.(4grades)

c-

d- Find the roots of the equation $x^4 - x^3 - 4x^2 + 5x - 2 = 0$, given that $x = 1$ is a repeated root to this equation.(5grades)

Good luck ....

Department: Math
Course Code: M 111 Term: First, 2015/2016
Course Title: General Math Total points: 70
Date: 28 /1/2015 Time Allowed:2 hours
Professor(s) Name(s):Dr. Ragab Omar&Dr. Hamed

Answer all the following equations:

[1] a)Find the following integrals:

1) $\int \frac{2}{1+e^x} dx$ 2) $\int (4+\tan x)^{18} \sec^2 x \, dx$ iii) $\int (x^3+5)^{32} \, x^2 \, dx$

b)Find $(\frac{dy}{dx})$ for each of the following:

i) $y = (1+x^3)^x$, ii) $y = \tan Ln\left(e^{\tan^{-1}\sqrt{x}}\right)$ $iii) y = \sec\sqrt{x^2+3}$

[2] a) Find the following limits :

$$i) \lim_{x\to\frac{\pi}{2}} \frac{2\cos x}{2x-\pi} \qquad ii) \lim_{x\to 0} (\cos x)^{\frac{1}{x^2}}$$

b) *Find* $\frac{d^n y}{dx^n} y$ for $y = \sin(ax+b)$

c)If y=Ln (sec x+tan x) Prove that

$$y'' = \frac{d^2y}{dx^2} = \sec x \tan x$$

Damanhour University
Faculty of Sciences
Mathematics Department

First Term Exam For The School Year 2015-2016

Level : Two
Time: 2:00 hours

Subject: Biostatistics (Stat 122)

Answer the following questions :-

Q1: (a) If the total cholesterol values for a certain target population are normally distributed with a mean of 200 (mg/100 mL) and a standard deviation of 20 (mg/100 mL). A person has been picked at random from this population. What is the probability that he will have a cholesterol value greater than 240 (mg/100 mL).

(b) The following table consisting of weights in pounds (lb) from a sample of 10 adult men as the predictor or X variable and their systolic blood pressure (SBP) in millimeters of mercury (mmHg) as the outcome or Y variable. Fit the least squares regression line of Y on X.

Number	1	2	3	4	5	6	7	8	9	10
Weight(lb)	165	243	180	152	163	210	203	195	178	218
SBP(rnmHg)	134	155	137	124	128	131	143	136	127	146

(c) In a certain state, 58 landfills are classified according to their concentration of three hazardous chemicals: arsenic, barium, and mercury. Suppose that the concentration of each one of the three chemicals is characterized as either high or low as in the following table.

	Barium			
	High		Low	
	Mercury		Mercury	
Arsenic	High	Low	High	Low
High	1	3	5	9
Low	4	8	10	18

If a landfill is chosen at random from among the 58, what is the probability that it has high concentration of barium? High concentration of mercury and low concentration of both arsenic and barium? High concentration of any two of the chemicals and low concentration of the third? High concentration of any one of the chemicals and low concentration of the other two?

Q2: (a) Suppose that we select a whole number at random between 100 and 999, inclusive. What is the probability that it has at least one 1 in it? What is the probability that it has exactly two 3's in it?

(b) Let B, A be events from a sample space S such that $P(A \cap B^c) = 0.5$, $P(A \cap B) = 0.2$, $P(A^c \cap B^c) = 0.1$, compute $P(A^c), P(A \backslash B), P(A \backslash B^c)$

Q3: (a) Let X be a continuous random variable with distribution function:

$$F_X(t) = \begin{cases} 0 & t \le 0 \\ 2c\left(t^2 - \frac{1}{3}t^3\right), & 0 < t \le 2 \\ 1, & t > 2. \end{cases}$$

(i) Determine the corresponding density function. (ii) Determine the constant c..

(b) Consider a family of exactly two children. Find the probabilities

(1) that both are girls, (2) both are girls given that one of them is a girl, (3) both are girls given that the elder child is a girl, and (4) both are girls given that both are girls.

With Best Wishes

يسمح للطالب إحضار الجداول الإحصائية

Damanhur University
Faculty of Science
Department of Mathematics
Course Title : Special Functions
Course code : M 304

Year : Third year
Term: 1st term
Time allowed: 2 hours
Date: Monday 4 /1/2016
Exam Marks: 70

Answer ALL the Following Questions:

The First Question:

Prove that : a) $\int_0^{\pi/2} \sin^{2m-1}\theta \cos^{2n-1}\theta d\theta = \frac{\Gamma(m)\Gamma(n)}{2\Gamma(m+n)}$ $, m, n > 0,$

b) $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$

The Second Question:

b)-Prove that : $(n+1)P_{n+1}(x) - (2n+1)xP_n(x) + nP_{n-1}(x) = 0$

a)-Show that $P_n(x)$ satisfies Legendre's differential equation:

$$(1-x^2)\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + n(n+1)y = 0$$

The Third Question:

a)-Prove that : i)- $\int_{-1}^{1} P_m(x)P_n(x)dx = o, m \neq n$ $ii) - \int_{-1}^{1} P_n^{\,2}(x)dx = \frac{2}{2n+1}.$

b)-Prove that : $J_{-m}(x)=(-1)^m J_m(x)$,where m is a positive integer.

The Fourth Question:

a)-Prove that : $J_m(x)=\frac{(\frac{x}{2})^m}{\sqrt{\pi}\Gamma(m+1/2)}\int_{-1}^{1}(1-t^2)^{m-\frac{1}{2}}e^{ixt}dt$,where $m>-\frac{1}{2}$.

b)-Prove that : i) $H_n'(x)=2nH_{n-1}(x)$

$$ii)2xH_n(x)-2nH_{n-1}(x)-H_{n+1}(x)=0.$$

Where $H_n(x)$ is Hermite polynomial.

Damanhour University Faculty of Science
Fourth Year Exam. Complex Functions
First Term 2016 Time: 2 hours.

Answer the following questions

(1) a) Establish Cauchy Riemann Equations for an analytic function $f(z) = u(x,y) + iv(x,y)$, hence show that $f(z) = \sin z$ is analytic, $z = x+iy$.

b) Using Riemann's definition of integration for a complex function, prove that $\int_C \frac{dz}{z} = 2\pi i$, where C is the circle $|z| = R$.

(2) a) Give a definition for an integral function $f(z)$, hence state and prove Liouville theorem.

b) State and prove Cauchy's theorem using Green's theorem.

(3) Prove that $f^{(n)}(a) = \frac{n!}{2\pi i}\int_C \frac{f(z)\,dz}{(z-a)^{n+1}}$ when $n=0$, $a \in$ Int. C

hence evaluate $\int_{|z-\frac{\pi}{4}|=4} \frac{\sin z\,dz}{(z-\frac{\pi}{4})^4}$, $\int_{|z-2|=6} \frac{\cos \pi z}{z^2-1}\,dz$

(4) a) Find the Laurent series for the function $f(z) = \frac{1}{z^2(z-3)}$ at $z = 3$

b) Find the poles and the Residues for the functions $f(z) = \frac{ze^z}{(z-1)(z-2)^2}$, $g(z) = \frac{z}{\cosh z}$, at the poles of each function.

"With Best Wishes"

Prof. Dr. Fathi Barakat

Department: Mathematics
Year: Third
Section: Mathematics
Course Code: Math 308
Course Title:
Term: First, 2015/2016
Date: / 1 /2016
Time Allowed: 2 hours
Total points: 100 point
Dr. Name(s): Fatma Gaafar

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Answer the following questions

(1) a- Show that $\mathbf{u(x,y) = x(1-y)}$ is harmonic and find its conjugate harmonic function v(x,y). Write $\mathbf{u(x,y) + iv(x,y)}$ as $\mathbf{f(z)}$.

b- Find the **polar** form of Cauchy- Riemann Equations.

c- State necessary and sufficient conditions for a function $\mathbf{f(z) = u(x,y) + iv(x,y)}$ to be analytic in a domain D

and prove necessary **or** sufficient only

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(2) a- prove that if $\mathbf{f(z)}$ is an analytic function inside and on a simple closed curve **C** with domain **D** then

$$\mathbf{f'(a) = \frac{1}{2\pi i} \oint_C \frac{f(z)}{(z-a)^2} dz \quad , \quad a \in D}$$

b- Prove If the function $\mathbf{f(z)}$ is analytic and bounded in the complex plane, then $\mathbf{f(z)}$ is a constant function "Liouville's Theorem".

c- Determine $I = \int_C |dz|$ where C is any curve join the two points z_0 and z_1

Please turn over

(3) a- Define three types of singularities and give an example for each?

b- Evaluating using the residue theorem.

(i) $\oint_C \frac{2z-3}{z^3+3z^2}\,dz$ where C is $|z|=4$ traversed counterclockwise.

(ii) $\int_0^{2\pi} \frac{(\sin x)^2}{\frac{5}{4}-\cos x}\,dx$

c- If $f(z)$ has a pole of order m at $z=a$ prove that

$$\operatorname*{Res}_{z=a} f(z) = \frac{1}{(m-1)!}\lim_{z\to a}\frac{d^{m-1}}{dz^{m-1}}\left\{(z-a)^m f(z)\right\}.$$

---

(4) a- State the Taylor and the Laurent series for expansion the function $f(z)$ and prove **one** of them.

b- Expand $f(z)=\frac{1}{z(z-2)}$ about $z=i$ in $\sqrt{5}<|z-i|<\infty$

c- Define multiple connected region and state and prove Cauchy's Theorem for multiple connected region

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☺ GOOD LUCK

مع أطيب التمنيات بالنجاح والتوفيق

Damanhur University
Faculty of Science
Department of Mathematics
Course Title : Mathematics for chemistry (1)
Course code : M 231

Year : Second year
Term: 1st term
Time allowed: 2 hours
Date: Sunday 10 /1/2016
Exam Marks: 70

Answer ALL the Following Questions:

The First Question:

a)Investigate the limiting behavior of $f(x,y)=\frac{2x^2y}{x^4+y^2}$ as (x,y) approaches $(0,0)$.

b) Find a normal vector and equations of the tangent plane and normal line to the graph $z=\sin(xy)$ at the point where $x=\pi/3$ and $y=-1$

The Second Question:

a)The density of the solid is given by $\rho(x,y,z)=x+2y+4z \quad kg/m^3$ where $S=\{(x,y,z): 0\le x\le 1, x^2\le y\le x, x-y\le z\le x+y\}$ .Calculate the total mass of the solid .

b) Calculate $\int_C F(x)\bullet dx$, where $F(x,y)=xyi+ye^x j$ and C is the rectangle joining the points $(0,0),(2,0),(2,1)$,and $(0,1)$ if C is traversed in the counterclockwise direction.

DepartmeYear: second
Section:C+Z &C+PHY &C+MICB & C+BOT
Course Code: 231R
Course Title: Pure Math
Term: Frist , 2015/2016
Date: 10 /1/2016
Time Allowed: 2 hour
Professor Name : Dr. Ragab Omar & Dr.Asam

جامعة دمنهور
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اولا المصفوفات والمعادلات التفاضلية أجب عن الأسئلة الآتية :

[1] أ- أوجد حل المعادلة التفاضلية الآتية

$$\frac{dy}{dx} = \frac{x^2+y^2}{xy}$$

ب- حدد نوع المعادلة التفاضلية الآتية $\frac{dy}{dx} + xy = xy^3$ ثم أوجد حلها

ج- أوجد حل المعادلات التفاضلية الآتية : $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 8x^2 + 10$

i) $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 24x^2 + 16$ $\quad ii)$ $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 12sin2x$

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[2] أ- باستخدام طريقة جاوس للحذف أوجد حل مجموعة المعادلات الآتية:

$$X+2y-z=5,\ 2x-y+z=3,\ 4x+y-2z=8$$

ب- اذا كانت B مصفوفة متماثلة والمصفوفة C سلبية التماثل من نفس الرتبة واذا كانت

$Q = (B+C)^{-1}\ (B-C)$ برهن على ان

$$Q^T\ (B+C)Q = (B+C)$$

ج- اذا كانت المصفوفة $A_\theta = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$

برهن على أن

i) $A_\theta A_\emptyset = A_{\theta+\emptyset}$ $\qquad$ ii) $A_\theta A_{-\theta} = I$

حيث I هى مصفوفة الوحدة

انظر خلفه

Damanhur University
Faculty of Science
Department of Mathematics
Course Title : Mathematical Analysis
Course code : M221

Year : Second year
Term: 1st term
Time allowed: 2 hours
Date: Sunday 10 /1/2016
Exam Marks: 70

Answer ALL the Following Questions:

The First Question:

a)**Investigate the limiting behavior of** $f(x,y)=\frac{2xy}{x^2+y^2}$ as (x,y) **approaches** $(0,0)$.

b) **Find a normal vector and equations of the tangent plane and normal line to the graph** $z=\sin(xy)$ **at the point where** $x=\pi/3$ **and** $y=-1$

The Second Question:

a)**Find the volume of the solid under the surface** $z=(x^2+y^2)$ **and lying above the region** $R=\{(x,y);0\le x\le 1 \quad and \quad x^2\le y\le\sqrt{x}\}$.

b)Find the general solution of the liner differential equation

$\frac{dy}{dx}-\frac{2}{x}(y)=(x^2)\cos 4x$

The Third Question:

a)Find the general solution of the liner differential equation

$$\frac{1}{x}\frac{dy}{dx}+\frac{1}{x}(y)=(y^3)$$

b) Find the general solution of the differential equation $(D^3+4D^2+3D)y=x^2$

The Fourth Question:

a)**Calculate** $\int F(x)\bullet dx, where F(x,y)=xyi+ye^x j$ **and C is the rectangle joining the points (0,0),(2,0),(2,1),and (0,1) if C is traversed in the counterclockwise direction.**

b)**Prove that the expression** $\left(y^2\ln\frac{y}{x}-y^2\right)dx+\left(2x\ y\ln\frac{y}{x}+xy\right)dy$ **is exact and find the function** $u(x,y)$.

Course Code: M354
Course Title: Method of Applied Mathematics (1)
Year: 3rd
Section: Physics/ math
Term: Second (2016)
Time Allowed: 2 hours
Total Points: 70
Date: 13/1/2016
Dr.: Shreen Elsapa

Damanhour University
Faculty of Science
Department of Mathematics

Answer All Questions

Q1: (Mark 15)

1)Find Fourier series of $f(x)=x$ *on* $[-\pi,\pi]$ and determine its sum for $-\pi<x<\pi$.

2)Use series expansion techniques to solve the following boundary value problem:

$$u_t = u_{xx} + t, \qquad 0 \le x \le \pi, \ t \ge 0$$

Subject to the boundary conditions

$$u(0,t)=0, \ u(\pi,t)=0$$

and initial condition

$$u(x,0)=x^2$$

Q2: (Mark 15)

a) Define Laplace transform and prove that

i. $L\left[\dfrac{df(x,t)}{dt}\right]=sF(x,s)-f(x,0)$

ii. $L\left[\dfrac{d^2f(x,t)}{dt^2}\right]=s^2F(x,s)-sf(x,0)-f'(x,0)$

b) Using Laplace transformation to solve the initial value problem:

$$\frac{d^2y}{dx^2}+y=f(t), \ y(0)=2, \ y'(0)=-1$$

where

$$f(t)=1-2U\left(t-\frac{\pi}{2}\right)$$

is the Heaviside unit step function.

Please turn over